THE FLORIDA ENTOMOLOGIST

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The Florida Entomologist

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Published quarterly by the FLORIDA ENTOMOLOGICAL SOCIETY
Box 2425, University Station, University of Florida, Gainesville

Mailing Date: March 24, 1950

The
FLORIDA ENTOMOLOGIST

VOL. XXXIII MARCH 1950 NO. 1

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Manuscripts and other editorial matter should be sent to the Editor, Dr. Lewis Berner, Biology Department, University of Florida, Gainesville. Subscriptions and orders for back numbers are handled by the Business Manager, Dr. L. C. Kuitert, Box 2425, University Station, University of Florida, Gainesville. The Secretary can be reached at the same address.

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SIX NEW APHIDS FROM PENNSYLVANIA

J. O. PEPPER[1]

While collecting and making a study of the aphids of Pennsylvania a number of species have been collected that are apparently new to science and it seems well that they should be described and recorded. Six new species are treated in this paper.

Acknowledgments are due A. N. Tissot, Gainesville, Florida, and Miss Louise Russell, Washington, D. C., for their examination of specimens and opinions concerning these forms. The writer is deeply grateful to Dr. Tissot for his encouragement and helpful, constructive suggestions in the preparation of this paper.

Macrosiphum pennsylvanicum new species

ALATE VIVIPAROUS FEMALE. (Plate I, Figs. 1, 2, 3, and 4.) *Color.*—General body color in life is green, about the same shade as the yarrow foliage. Head dusky-black; eyes red; antennae black; rostrum pale, except the apical one-third which is black. With a hand lens two rows of whitish pulverulent small dots are visible on each side of the mid-dorsal abdominal line, these dots more prominent in some specimens than in others. Wings hyaline with stigma and all veins dark. Legs black except the basal half of femora which is light yellow. Cornicles black; cauda pale to dusky. *Cleared specimens.*—Head and antennal I light brown with antennal II darker. Base of segment III light, remainder of III and other antennal segments brown, however, the unguis is somewhat lighter in most specimens. Rostral segments III to V dark brown, basal segments light brown. Thorax light dusky-brown; all legs with basal half of femora light, shading to dark brown apically; tibiae and tarsi brown. Cornicles dark brown, extreme bases light. Cauda and anal plate light dusky brown. *Measurements.*—Vertex to end of anal plate 2.17 (1.99-2.75)[2]. Head width across the eyes .457 (.434-.476), Antennal III, .884 (.798-.966); IV, .630 (.546-.658); V, .536 (.518-.602); VI, .190 (.182-.196) plus .867 (.840-.896). Cornicle length .456 (.378-.490), width .056, length of reticulated area .256. Cauda length .325 (.294-.350). *Structural characters.*—Sensoria on antennal III, 48 (40-56); 0 on IV; primary ones on V and VI. Those on III are very tuberculate and scattered over the entire length of segment. Some of the sensoria are bulbous and their size is variable. Hairs on antennal segments heavy and spine-like. A few are slightly longer than the diameter of the segments. The same is true of the tibial hairs. The hairs on the abdomen are fairly abundant and spine-like, measuring .070. There are 4 or 5 hairs on each side of the cauda and 2 or 3 on the dorsal area near the apex. The cornicles are imbricated from the base to the reticulated area with an apical flange. Rostrum lance-like and reaching third coxae.

Described from 61 individuals.

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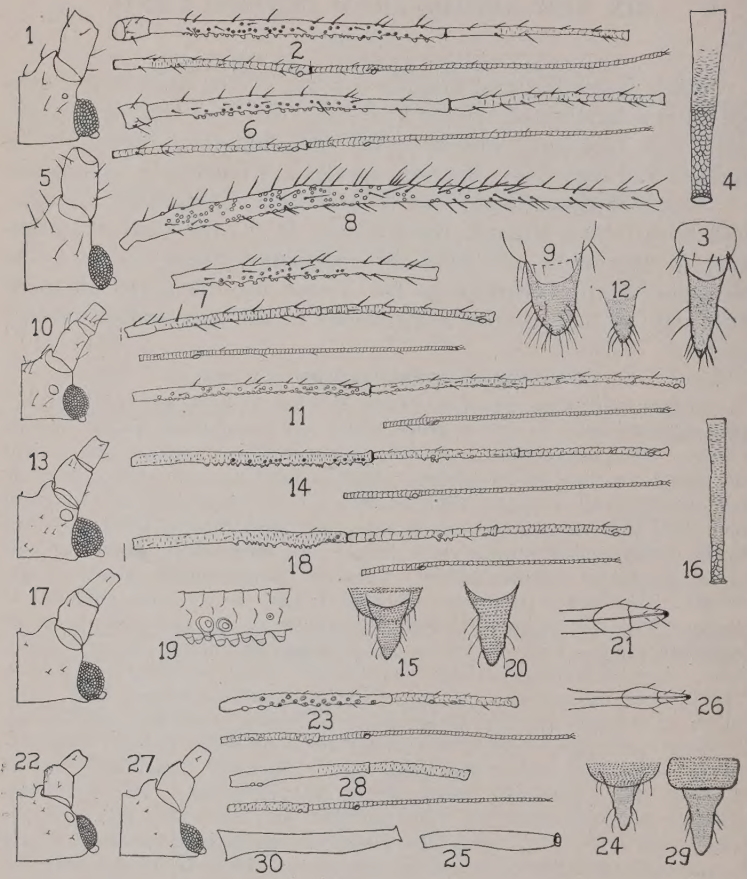
[1] Division of Extension Entomology, Pennsylvania State College, State College, Pennsylvania.

[2] All measurements in this paper are in millimeters; figures in parentheses indicate variations.



EXPLANATION OF PLATE I

Macrosiphum pennsylvanicum n. sp. Figs. 1-12.
1-4 alate viviparous female; 5-6 apterous viviparous female; 7-9 apterous oviparous female; 10-12 alate male.
Macrosiphum sleesmani n. sp. Figs. 13-21
13-16 alate viviparous female; 17-21 apterous viviparous female.
Myzus physocarpi n. sp. Figs. 22-30
22-26 alate viviparous female; 27-30 apterous viviparous female.
All figures 50× except Fig. 19 which is 200×.

APTEROUS VIVIPAROUS FEMALE. (Plate I, Figs. 5 and 6.) *Color.*—Same as the alate except the pulverulent dots merge on the thorax. The light yellow bases of femora are not as conspicuous as in the alate. Cauda dusky

in most specimens. Cleared specimens in general show same coloration as the alates, some individuals darker with the tibiae, tarsi, and cornicles appearing black. *Measurements.*—Vertex to end of anal plate 2.20 (1.92-2.45). Head width across eyes .494 (.476-.504). Antennal III, .896 (.798-.952); IV, .640 (.574-.700); V, .578 (.546-.588); VI, .193 (.182-.210) plus .858 (.812-.924). Cornicle length .581 (.490-.658), width .068, length of reticulated area .267 (.224-.280). Cauda length .421 (.378-.448). *Structural characters.*—Sensoria on antennal III, 37 (31-44); 0 on IV; primary ones on V and VI. Those on III are strongly tuberculate and distributed as shown in figure. All other characters are as in the alate.

Described from 75 individuals.

ALATE MALE. (Plate I, Figs. 10, 11, and 12.) *Color.*—Cleared specimens—head brown, lighter on posterior part. Antennal I and II light brown. Extreme base of III light, remainder of III and other segments brown. Beak light brown with IV and V brown. Prothorax light, meso- and meta-thorax brown. Extreme bases of femora light, darker to almost black apically; tibiae brown with lighter middle area; tarsi brown. Abdomen light; cornicles brown with bases light; cauda light to dusky brown. *Measurements.*—Vertex to end of anal plate 1.62 (1.47-1.75). Head width across the eyes .42 (.40-.43). Antennal III, .74 (.67-.78); IV, .53 (.43-.60); V, .48 (.39-.54); VI, .18 (.15-.20) plus .73 (.61-.89). Length of cornicle .19 (.16-.21), width at middle .035. Length of cauda .16 (.14-.17). *Structural characters.*—Head, beak and antennal segments bearing several hairs. Antennal III with 56 (46-62) round, tuberculate sensoria; IV, with 23 (17-30); V, with 15 (11-18); VI, with the primary one and several small ones at its edge. Abdomen with several hairs. Cornicles imbricated on basal half and reticulated on apical half. Cauda short with 8 hairs.

Described from 8 specimens.

APTEROUS OVIPAROUS FEMALE. (Plate I, Figs. 7, 8, and 9.) *Color.*—Cleared specimens—head, beak, antennal I and II brown, sometimes I and II darker than the head. Extreme base of antennal III light, the remainder of III, and other segments brown. Thorax and abdomen light. Femora light with a brown band just before apex; tibiae with bases and apices brown with light area between. Cornicles brown, bases sometimes lighter; cauda light dusky brown. *Measurements.*—Vertex to end of anal plate 2.19 (1.89-2.75). Head width across the eyes .48 (.47-.49). Antennal III, .79 (.73-.83); IV, .54 (.49-.59); V, .48 (.43-.52); VI, .18 plus .73 (.60-.77). Length of cornicle .45 (.43-.50), width at middle .052. Length of cauda .27 (.24-.29). *Structural characters.*—Head, antennae and abdomen with numerous hairs, some of those on antennae slightly longer than the diameter of the segments. Sensoria on basal two-thirds of III, numbering 25 (20-30), round, tuberculate, and in some individuals bulbous, as shown in figure. Segment IV without sensoria; V and VI with the primary ones. The beak long, reaching just beyond third coxae, and tapers to a point. The basal three-fourths of cornicles imbricated, the apical one-fourth reticulated. The cauda is short and broad, tapering to a blunt point with many hairs (18-24). The basal two-thirds of hind tibia is swollen and bears many round sensoria, varying in size. Hairs on outside of the tibia numerous, about as long as the diameter of the tibia; these hairs reclinate on apical portion.

Described from 47 individuals.

TYPES: All specimens of this species were collected by the author in Pennsylvania on *Achillea millefolium*. *Holotype*, alate viviparous female, Philipsburg (Black Moshannon Dam) July 4, 1947, (on slide with morphotype apterous female). *Morphotype*, apterous viviparous female, same data. *Allotype*, male, State College, October 13, 1949 (on slide with morphotype apterous oviparous female and other apterous females). Morphotype, apterous oviparous female on same slide as allotype and same data. *Paratypes*, 6 slides, Philipsburg, (Black Moshannon Dam), July 4, 1947; 5 slides, same locality, August 23, 1943; 8 slides, same locality, September 2, 1942; 3 slides, State College, (No. 133), August 29, 1942; 3 slides, State College, (Greenwood Furnace), August 24, 1946; 3 slides, Woodward, September 16, 1946; 20 slides, Quarryville, (304-44), June 16, 1944; 12 slides, State College, October 13, 1949.

The holotype, allotype, morphotypes, and a number of paratype specimens, deposited in the U. S. National Museum (Cat. No. 59413): the remaining paratype material in the collections of the writer and of A. N. Tissot.

TYPE LOCALITY: State College, Pennsylvania.

HOST: *Achillea millefolium*.

TAXONOMY: This species keys out to *M. ludovicianae* Oestl. in both Gillette and Palmer's Aphidae of Colorado and Hottes and Frison's Aphiidae of Illinois but differs in the following respects: It has a greater number of sensoria on antennal III in both alate and apterous viviparous females; the sensoria are more tuberculate; segments 4 plus 5 of beak are shorter; the cornicles are shorter and not as slender; and the cauda has fewer hairs and has them located more apically than in *ludovicianae*.

Macrosiphum sleesmani new species

ALATE VIVIPAROUS FEMALE. (Plate I, Figs. 13, 14, 15, and 16.) *Color.*—The collector noted that living specimens were lemon yellow to lemon green. In cleared specimens head, thorax, antennal I and II, light brown, the remaining antennal segments, rostrum, cornicles, tibiae, and tarsi darker. Femora light brown with darker apices. Cauda light. *Measurements.*—Vertex to end of anal plate 1.83 (1.36-2.06). Head width across eyes .436 (.420-.462). Antennal III, .609 (.560-.672); IV, .390 (.336-.434); V, .370 (.322-.406); VI, .212 (.196-.238) plus .618 (.546-.686). Cornicle length .390 (.350-.420), width .042, length of reticulated area .078 (.070-.084). Cauda length .198 (.182-.210). *Structural characters.*—The sensoria on antennal III extend over the apical three-fourths of the segment and are located mostly on one side. They are small, very tuberculate, and difficult to count

accurately because two or more sensoria arise from a single base in many cases (Plate I, Fig. 19). Sensoria on III, 44 (35-47); IV, 7 (5-10); V and VI the primary ones. Segments III, IV, V, and VI show distinct imbrications. Antennal tubercles rather small for the genus but extending well beyond the vertex. Rostrum short, broadly obtuse, reaching midway between first and second coxae. Wings hyaline with stigma and veins brown, the latter narrowly bordered with light shading. The venation of the fore wings rather unusual for this genus. The radial sector long, arising well before the pointed apex of the stigma. The first fork of the media nearer the base than the wing margin, the second fork very close to the margin, in many individuals entirely lacking. Cornicles are almost parallel sided, the apical one-fifth is reticulated and the remainder is imbricated. Cauda very slightly constricted, tapering to a blunt point, with 3 to 4 long hairs on each side and usually 1 on the dorsum. Hairs on body and appendages minute and inconspicuous. Length of those on antennae .01, on tibiae .03.

APTEROUS VIVIPAROUS FEMALE. (Plate I, Figs. 17, 18, 19, 20, and 21.) *Color.*—Same as in alate viviparous female, except somewhat lighter, and the entire femora are light. *Measurements.*—Vertex to end of anal plate 1.88 (1.61-2.10). Head width across the eyes .451 (.392-.490). Antennal III, .566 (.420-.672); IV, .349 (.224-.420); V, .318 (.238-.350); VI, .183 (.140-.210) plus .555 (.476-.616). Cornicle length .414 (.280-.504), width .050, length of reticulated area .070. Cauda length .200. *Structural characters.*—Sensoria on III, 25 (10-37); 0 to 4 on IV; the primary ones on V and VI. All other characters as in the alate.

TYPES.—All specimens of this species collected in Pennsylvania by G. B. Sleesman on *Adiantum pedatum*. *Holotype,* alate viviparous female (on same slide with morphotype apterous viviparous female and 1 paratype apterous female and 1 immature form), Richlandtown, June 8, 1949. *Morphotype,* apterous viviparous female (on same slide as holotype), locality, date, and host data same as on holotype slide. *Paratypes,* two slides, Glenmore, (Vick's Nursery), September 23, 1945, bearing eleven apterous viviparous females; six slides, Richlandtown, June 8, 1949, bearing 7 alate and 8 apterous viviparous females.

The holotype and morphotype specimens, deposited in the U. S. National Museum (Cat. No. 59414); the remaining paratype material in the collections of the writer and of A. N. Tissot.

This species is named for George B. Sleesman, who has collected many interesting aphids for the writer.

TAXONOMY AND NOTES: Some of the characters are like those found in *Macrosiphum* and *Kakimia* but in other respects it is different from either of these genera. The peculiar sensoria on antennal segments III and IV are different from any known to the writer. The venation of the forewings is unusual and the cauda

is suggestive of the genus *Myzus*. A new genus could be erected for this species but the writer prefers to leave it in *Macrosiphum* for the present.

Myzus physocarpi new species

ALATE VIVIPAROUS FEMALE. (Plate I, Figs. 22, 23, 24, 25, and 26.) *Color.*—General body color of live specimens, light greenish; head, antennae, thorax and cornicles black; legs, rostrum and cauda light brown. In cleared specimens, head, thorax, antennal I and II, brown; extreme base of III light, remainder of III and the remaining segments brown; V and VI somewhat lighter. The coxae, trochanters and bases of femora light brown with femora shading to dark brown on apices; tibiae and tarsi brown. Abdomen with three lateral black spots on each side anterior to and one just posterior to cornicles; five smaller, irregular black spots on each side located just dorsally of the lateral ones, the posterior two between the cornicles; cornicles, cauda and anal plate light brown. Wings hyaline with stigma and all veins dark. *Measurements.*—Vertex to end of anal plate 1.80 (1.61-1.91). Head width across the eyes .402 (.392-.420). Antennal III, .508 (.462-.588); IV, .307 (.252-.336); V, .294 (.252-.364); VI, .147 (.140-.154) plus .568 (.504-.616). Cornicle length .365 (.350-.392), width .056. Cauda length .179 (.160-.196). *Structural characters.*—Sensoria on antennae circular and located as shown in figure; number on III, 15 (12-18); IV, 0 to 5; V, 1 to 4; VI, the large primary one and smaller accessory ones about it. All segments distinctly imbricated. Inner margin of segment I, slightly protuberant. Antennal tubercles of medium size, imbricated, moderately convergent. Rostrum broadly obtuse, extending almost to middle coxae. Cornicle with slight imbrications, basal portion constricted, the middle portion swollen and then tapering to apical flange. Cauda slightly constricted, tapering to a blunt point, with 2 to 3 hairs on each side. Hairs on body and appendages minute; length of those on antennae hardly .01; on abdomen .017; on tibiae .02.

APTEROUS VIVIPAROUS FEMALE. (Plate I, Figs. 27, 28, 29, and 30.) *Color.*—General color of living specimens is much lighter than in the alate. Cleared specimens appear almost colorless and there are no dark spots on the abdomen as in the alate. *Measurements.*—Vertex to end of anal plate 1.90 (1.71-2.10). Head width across the eyes .423 (.392-.434). Antennal III, .435 (.336-.476); IV, .251 (.168-.294); V, .253 (.196-.310); VI, .143 (.140-.154) plus .468 (.280-.560). Cornicle length .434 (.322-.476), width .06. Cauda length .222 (.196-.238). *Structural characters.*—There are 0 to 3 circular sensoria located on a slightly swollen area on the base of III; 0 on IV; primary ones on V and VI. Other characters as in alate, except cornicle bases appear wrinkled and the remainder smooth.

TYPES.—All specimens of this species were collected in Pennsylvania on *Physocarpus opulifolius*. *Holotype,* alate viviparous female (on slide with 1 paratype apterous viviparous female), Spruce Creek, Colerain Park), April 25, 1945 (No. 5-45). *Morphotype,* apterous viviparous female (on slide with 2 paratype alate viviparous females), same location, date and host data as

for holotype. *Paratypes*, 21 slides, same location, date and host data as for holotype. These slides bear 47 alates and 20 apterous viviparous females. All collections by the writer.

The holotype and morphotype specimens are deposited in the U. S. National Museum (Cat. No. 59415), the remaining type specimens are in the collections of the writer and of A. N. Tissot.

TYPE LOCALITY.—Spruce Creek, Pennsylvania.

HOST.—*Physocarpus opulifolius* (L.) Maxim.

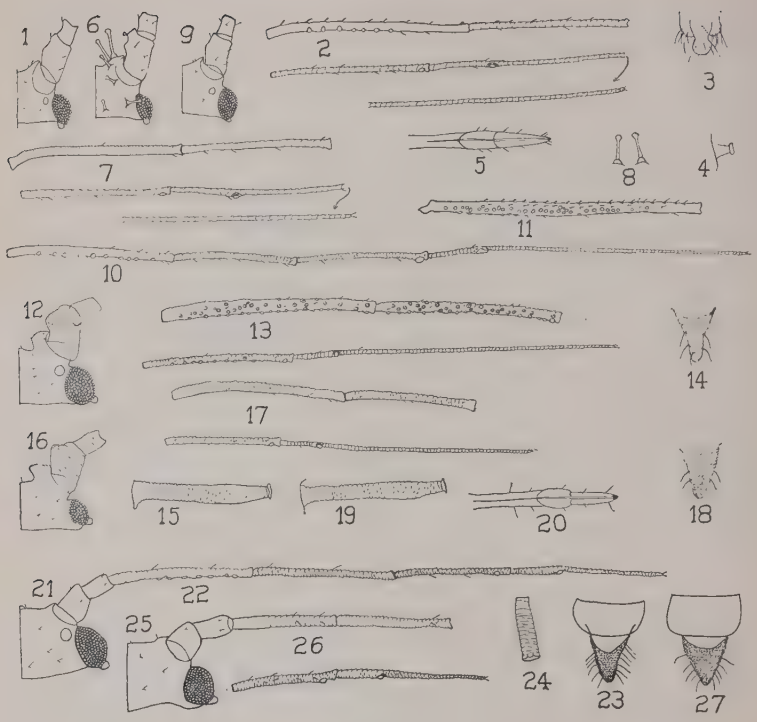
TAXONOMY AND NOTES.—The specimens occur on the under sides of the leaves of the tender water sprout growth in the spring and early summer and then disappear from the plant. This species keys out fairly well to *M. eriobotryae* Tissot, in Mason's key. Specimens were sent to Dr. A. N. Tissot and he states that it is definitely not that species. He also made these remarks "*M. eriobotryae* has IV plus V of rostrum long, slender and almost parallel sided. This species has the rostrum short, blunt, and tapering. Also *M. eriobotryae* has 2 tubercles on the hind margin of the under side of the head; your species has none."

Calaphis alnosa new species

ALATE VIVIPAROUS FEMALE. (Plate II, Figs. 1, 2, 3, 4, and 5.) *Color.*—General color of living specimens a very light pale green, antennae and legs black. In cleared specimens the head, antennal I and II almost colorless, base of III light brown, remainder of III and other segments dark brown. The coxae, trochanters, and femora dusky-brown; tibiae with basal one-fourth light brown shading to dark brown apically. Cornicles and cauda almost hyaline. Wings hyaline with veins and lower margin of stigma dark brown; first anal and cubitus narrowly bordered with brown shading, only a slight indication of shading on media. *Measurements.*—Vertex to end of anal plate 1.46 (1.36-1.57). Head width across eyes .322 (.308-.350). Antennal III, .609 (.532-.672); IV, .478 (.450-.546); V, .465 (.420-.518); VI, .213 (.168-.238) plus 1.19 (1.02-1.68). Cornicle length .056 (.042-.070), width .028. Length of hind tibia 1.00 (.896-1.11). *Structural characters.*—The antennae are held horizontally back over the body. The basal one-third of antennal III is slightly curved. There are 7 (5-9) large oval sensoria in a single row on III; 0 on IV; the primary ones on V and VI. Apical one-third of III and all of IV, V, and VI are imbricated. Antennal I with a protuberance on inner margin. Rostrum tapers to a sharp point and reaches the third coxae. Fore wing with radial sector absent. Cornicles smooth, widest at base and taper to a rolled flange. Anal plate deeply bi-lobed. Cauda knobbed. Both anal plate and cauda bear fairly long hairs. Blunt hairs on antennal segments and base of tibia .012 long, those on apex of tibiae slightly longer.

Described from 58 specimens.

APTEROUS VIVIPAROUS FEMALE. (Plate II, Figs. 6, 7, and 8.) *Color.*—General body color of living specimens creamy white with a reddish-brown



EXPLANATION OF PLATE II

Calaphis alnosa n. sp. Figs. 1-11
1-5 alate viviparous female; 6-8 apterous viviparous female; 9-10 alate male; 11 apterous oviparous female.

Micromyzus collinsoniae n. sp. Figs. 12-20
12-15 alate viviparous female; 16-20 apterous viviparous female.

Aphis hamamelidis n. sp. Figs. 21-27
21-24 alate viviparous female; 25-27 apterous viviparous female.

All figures 50×.

lateral line on each side of the thorax and abdomen. Antennae and legs black. In cleared specimens head, antennal I and II almost colorless; basal two-thirds of III and basal half of IV light brown; the remainder of III, IV, and remaining segments are darker brown. Rostrum pale with brown tip. Legs almost colorless with apical one-third of tibiae and tarsi brown. *Measurements.*—Vertex to end of anal plate 1.45 (1.33-1.57). Head width across eyes .305 (.294-.322). Antennal III, .491 (.406-.560); IV, .393 (.350-.476); V, .371 (.308-.434); VI, .182 (.154-.224) plus .894 (.784-1.10). Cornicle length .058 and width .028. Length of hind tibia .815 (.714-.966). *Structural characters.*—Antennal III and IV without sensoria; primary

ones on V and VI. Base of III has a definite curve or bend. Segment III and basal two-thirds of IV appear smooth on posterior margin, the anterior margin of these two segments and both margins of remaining segments distinctly imbricated. Short reclining hairs on all segments, those on I and II capitate. Antennal tubercles with three stalked, capitate hairs on a large conical base. Rostrum tapering to acute point and reaches third coxae. The prothorax with a single stalked hair (.06) on conical base on each lateral margin. The meso-thorax has a large thumb-like, blunt tubercle on each side plus capitate, stalked hairs on the dorsum. Each abdominal segment bears several long, stalked capitate hairs on conical bases. Cornicle, cauda and anal plate same as in alate.

Described from 92 specimens.

APTEROUS OVIPAROUS FEMALE. (Plate II, Fig. 11.) *Color.*—Cleared specimens.—Head light with antennal tubercles and hair bases brown. Antennal I and II slightly dusky, II being more dusky than I. Basal two-thirds of III light brown with apical one-third and remaining segments almost black. Beak light with dark tip. Thorax, abdomen, cornicles, and cauda light; body hairs and their bases light brown. Femora light with tibiae and tarsi brown, the basal part of tibiae usually darker than the apical part. *Measurements.*—Vertex to end of anal plate 1.45 (1.33-1.64). Head width across the eyes .33 (.31-.34); Antennal III, .43 (.39-.46); IV, .33 (.29-.35); V, .34 (.32-.36); VI, .17 (.16-.18) plus .75 (.67-.84). Length of cornicle .056, width at middle .042. Length of hind tibia .72 (.66-.77). *Structural characters.*—Body with stalked capitate hairs on conical bases. Antennal I with a single short capitate hair on inner margin near apex plus several short blunt hairs scattered on the segment; short pointed, reclining hairs on remaining segments. Segments III to VI strongly imbricated. Segments III and IV without sensoria; V and VI with the primary ones. The meso-thorax has a large thumb-like tubercle on each side pointing backward and located dorsally to the regular meso-thoracic tubercle. Cornicles same as in apterous viviparous form. Anal plate broadly rounded and with many hairs. Cauda definitely knobbed and with several hairs. Hind tibiae with sensoriated areas somewhat swollen, round sensoria of varying sizes distributed over the basal three-fourths of the tibiae; the basal half of the outer edge bears about nine short capitate hairs, the remaining hairs on the tibiae are not capitate.

Described from 142 specimens.

ALATE MALE. (Plate II, Figs. 9 and 10). *Color.*—Cleared specimens—Head light dusky brown with vertex and front darker brown. Antennal I and II dusky brown; extreme base of III light with remainder of III, IV, V, and VI brown. Beak light with tip black. Pro- and meso-thorax light brown, meta-thorax darker brown. Femora dusky brown with tibiae and tarsi dark brown to black. Abdomen colorless to slightly dusky. Cornicles light to slightly dusky. *Measurements.*—Vertex to end of anal plate 1.15 (1.08-1.22). Head width across the eyes .34 (.33-.35). Antennal III, .45 (.42-.50); IV, .34 (.32-.36); V, .35 (.30-.40); VI, .18 plus .71. Length of cornicle .042, width at middle .028. Length of hind tibia .77 (.73-.82). *Structural characters.*—Antennae with apical one-third of III slightly imbricated; IV to VI strongly imbricated. Short hairs on all segments.

Segment III with 10 (9-11) large almost round sensoria; IV, without sensoria; V and VI, with primary ones. Abdominal hairs fairly abundant and heavy, some few slightly capitate.

Described from 3 specimens.

TYPES: All specimens of this species were collected by the writer in Pennsylvania on *Alnus rugosa*. *Holotype*—alate viviparous female and *Morphotype*—apterous viviparous female on same slide (also 5 paratype apterous viviparous females) State College, (Decker Valley), July 5, 1945. *Allotype*—male and Morphotype apterous oviparous female on same slide (also 3 paratype apterous oviparous females), State College, (Whipple Dam), October 23, 1949. *Paratypes*—1 slide, same locality and data as holotype slide; 1 slide, State College, (Greenwood Furnace), August 24, 1946; 14 slides, Ohiopyle, June 18, 1947. This is a total of 29 slides bearing 52 alate and 92 apterous viviparous females. Sixteen slides, State College, (Whipple Dam), October 23, 1949, bearing 3 alate males and 142 apterous oviparous females.

A slide containing a single alate viviparous female, Cashiers, N. C., August 24, 1941, A. N. Tissot and J. O. Pepper, on *Alnus?* has been examined and appears to be identical with this species but is not included with the type material.

The holotype, allotype, morphotype, and a number of paratype specimens, deposited in the U. S. National Museum (Cat. No. 59417), the remaining paratype material in the collections of the writer and of A. N. Tissot.

TYPE LOCALITY: State College (Decker Valley), Pennsylvania.

HOST: *Alnus rugosa*.

TAXONOMY AND NOTES: This species feeds on the under side of the leaves and alates are very hard to find. The apterous females adhere very closely to the mid-vein and other larger veins of the leaf and are difficult to see. They sometimes occur on the same leaves with *Myzocallis alnifoliae* Fitch but can be easily overlooked. The apterous oviparous females of this species and *M. alnifoliae* have been found together depositing eggs on the bark around the same buds or other rough places, but the color markings and size separate them easily.

Calaphis alni Baker occurs on *Alnue rugosa*, but it is a large species with definite color markings and feeds mainly on the stems and foliage of tender growing terminals.

Micromyzus collinsoniae new species

ALATE VIVIPAROUS FEMALE. (Plate II, Figs. 12, 13, 14, and 15.) *Color.*—The general body color in life is purple lake (Smith, Explanation of Terms Used in Entomology). In cleared specimens—head, brown with darker shading surrounding the ocelli. Antennal segments I and II darker than head. Extreme base of III light, middle portion brown fading to light brown apically; segments IV, V, and VI becoming progressively lighter, the unguis almost colorless. Beak light dusky with black tip. Thorax dusky, slightly darker than the head. Legs, with basal half of femora light and apical half dusky; tibiae and tarsi light dusky, the apical end of tibiae dark. Abdomen, light with 3 or 4 lateral dusky spots on each side. Cornicles and cauda light dusky. Anal plate dusky dark. *Measurements.*—Vertex to end of anal plate 1.88 (1.75-1.99). Head width across the eyes .40 (.39-.42). Antennal III, .60 (.59-.64); IV, .45 (.39-.49); V, .38 (.35-.43); VI, .13 (.11-.14) plus .64 (.53-.73). Cornicle length .36 (.32-.39), width .056. Cauda length .15 (.14-.16). *Structural characters.*—Head with prominent antennal tubercles which are gibbous and imbricated. On the posterior ventral part of head there are two large thumb-like tubercles located between rostrum and lateral margins. Antennal I and II imbricated, the inner apical margin of I gibbous. Sensoria on III circular, varying in size, and distributed over entire length of segment, numbering 46 (40-52); some of the sensoria are slightly tuberculate; segment IV with 29 (21-29) sensoria, distributed over entire length; V with 9 (6-11) sensoria, located mostly on one side and reaching almost the entire length of segment. All antennal segments are imbricated and bear several minute hairs. Basal one-half of cornicles narrow with wrinkled imbrications; middle portion swollen, tapering to wide flared apex; the entire surface of cornicles shows some reticulations. The anal plate broad, tapers to a blunt point and bears several large and small hairs. The cauda tapers to a point and bears 2 lateral hairs on each side and usually 1 dorsal hair.

Described from 23 individuals.

APTEROUS VIVIPAROUS FEMALE. (Plate II, Figs. 16, 17, 18, 19, and 20.) *Color.*—Coloration the same as in the alate, except lighter. *Measurements.*—Vertex to end of anal plate 1.40 (1.19-1.61). Head width across the eyes .37 (.35-.39). Antennal III, .46 (.43-.50); IV, .32 (.28-.38); V, .30 (.28-.31); VI, .12 plus .52 (.47-.56). Cornicle length .37 (.35-.39), width .056. Length of cauda .15 (.14-.18). *Structural characters.*—Dorsum of head covered with short curved rows of minute punctures. Antennal tubercles large and protruding strongly inward and roughened with numerous small tubercles. On the posterior ventral part of head there are two large thumb-like tubercles between rostrum and lateral margins that point backward; these are more prominent than in the alate. All antennal segments are imbricated, segment I has the inner apical part gibbous and roughened similar to antennal tubercles. Antennal segments III and IV without sensoria and only the primary ones on V and VI. All segments with minute spines. Beak is fairly long and almost parallel sided and reaches the third coxae. The skin of the abdomen is reticulated and bears many very short inconspicuous hairs. The cauda tapers gradually to a point and bears two or three hairs on each side. Cornicles same as in alate.

Described from 17 individuals.

TYPES: All specimens of this species were collected by the writer in Pennsylvania on *Collinsonia canadensis*. *Holotype*—alate viviparous female and *Morphotype*—apterous viviparous female on same slide (plus 1 paratype apterous viviparous female), State College (Greenwood Furnace), August 26, 1946. *Paratypes*—9 slides with same data as on holotype slide.

The holotype and morphotype specimens deposited in U. S. National Museum (Cat. No. 59416), the remaining paratype material in the collections of the writer and of A. N. Tissot.

TYPE LOCALITY: State College, Pennsylvania.

HOST: *Collinsonia canadensis*.

TAXONOMY: The aphid most similar to this species in *Micromyzus formosana* (Takah.) commonly called the "onion aphid". The following characters will help to distinguish these two species. The alate viviparous female of *collinsoniae* has a larger number of sensoria on antennal segments III, IV, and V than are found in *formosana*. The radial sector of the fore wing does not curve down as deeply and the veins are not as heavily bordered in *collinsoniae* as in *formosana*. The antennal tubercles and segment I of antennae in both alate and apterous forms of *collinsoniae* are more gibbous and imbricated than in *formosana*. These characters along with the different host plants distinguish *collinsoniae* from *formosana*.

Aphis hamamelidis new species

ALATE VIVIPAROUS FEMALE. (Plate II, Figs. 21, 22, 23, and 24.) *Color.*—General body color of living specimens salmon, covered with white pulverulence. Cleared specimens—head and thorax dark brown. Antennal I and II brown; extreme base of III light, remainder of III and remaining segments light brown. Abdomen with four interrupted black crossbands and a black patch between cornicles and cauda; four lateral dark spots on each side and dark areas around cornicle bases. Femora with extreme bases light brown shading to dark brown apically; tibiae light brown with apex darker; tarsi brown. Cornicles dark brown; cauda brown. Wings hyaline with stigma and all veins dark; in some specimens the veins appear to be bordered with smoky shading. *Measurements.*—Vertex to end of anal plate 1.95 (1.71-2.13). Head width across eyes .469 (.462-.490). Antennal III, .378 (.350-.406); IV, .351 (.322-.378); V, .319 (.294-.350); VI, .136 (.126-.140) plus .301 (.252-.336). Cornicle length .193 (.182-.196), width .048. Cauda length .144. *Structural characters.*—Round sensoria on antennal III arranged almost in a straight row and numbering 6 (5-7); 0 on IV; primary ones on V and VI. Antennal segments strongly imbricated except I and II. Cornicles imbricated. Each lateral margin of abdomen bears 4 prominent tubercles anterior to the cornicles and I posterior; some individuals with 2 additional tubercles located just anterior and

just posterior to the cornicle. Cauda with 5 to 8 hairs on each side. Rostrum acute and reaching almost to the middle coxae. Body hairs, .028 long; antennal hairs reclinate, .014 long; hairs on tibiae .020.

Described from 88 specimens.

APTEROUS VIVIPAROUS FEMALE. (Plate II, Figs. 25, 26, and 27.) *Color.*—Same as the alate except in general a little lighter and without dark cross bands or markings on the abdomen. *Measurements.*—Vertex to end of anal plate 1.88 (1.75-2.06). Head width across eyes .460 (.448-.504). Antennal III, .345 (.322-.378); IV, .304 (.266-.350); V, .292 (.266-.350); VI, .137 (.126-.140) plus .281 (.266-.322). Cornicle length .218 (.182-.224), width .065. Cauda length .176 (.154-.185). *Structural characters.*—Antennal segments III and IV without sensoria; primary ones on V and VI. Rostrum reaching third coxae. Body skin reticulated. Other features as in alate.

Described from 60 specimens.

TYPES: All specimens of this species were collected by the writer in Pennsylvania on *Hamamelis virginiana*. *Holotype*—alate viviparous female and Morphotype apterous viviparous female on same slide (plus 1 alate paratype and 1 pupa), State College, (Camp 62), June 9, 1946. *Paratypes*—6 slides, State College, (Camp 62), June 9, 1946; 10 slides same locality, June 14, 1942; 5 slides, State College, (Greenwood Furnace), June 15, 1947; 3 slides, State College, (Poe Paddy Park), June 22, 1947; 8 slides, Quarryville, (305-44), June 16, 1944; 1 slide Clarks Valley, August 11, 1931; 7 slides, Philipsburg (Black Moshannon Dam), July 7, 1946.

The holotype, morphotype and a number of paratype specimens, deposited in the U. S. National Museum (Cat. No. 59418); the remaining paratype material in the collections of the writer and of A. N. Tissot.

TYPE LOCALITY.—State College, Pennsylvania.

HOST.—*Hamamelis virginiana* L.

TAXONOMY AND NOTES.—This species has some characters that might place it in any of the following three genera—*Aphis*, *Anuraphis* and *Brevicoryne*. The writer feels that it comes nearest to *Aphis*. It feeds on the water-sprout growth and tender growing terminals. Only two other aphids, *Hamamelistes spinosus* Shimer, and *Hormaphis hamamelidis* Fitch, are known to feed on Witch Hazel, *Hamamelis virginiana* L.

SOURCE OF EARLY APHID INFESTATIONS IN SHADE-GROWN TOBACCO

F. S. CHAMBERLIN
U. S. D. A., Agr. Res. Adm., Bureau of Entomology and Plant Quarantine

Each spring since 1947 aphid populations, consisting mainly of the green peach aphid, *Myzus persicae* (Sulz.), have been found in tobacco plant beds in the Florida and Georgia shade-grown area. Although plant-bed infestations are generally light, they have been important sources of serious infestations on tobacco in the field. The soil in these plant beds is sterilized with steam or chemicals before the seed is sown, and the beds are inclosed on the tops and sides with one or more layers of tobacco shade-cloth. It therefore appears that the plant beds are initially infested by migrants having the ability to work their way into the bed inclosures. The source of these initial infestations has been the subject of limited investigations.

For several years collections in the area have shown generally light and varying populations of the green peach aphid present on turnips, collards, cabbage, and other crucifers during the fall and winter months. The insect has also been found occasionally on cultivated hosts of other families and on a number of wild plants. These, and nearly all aphids collected from tobacco, have been determined by specialists as the green peach aphid, but there is the possibility that the forms on tobacco are a different race, or even a different species, which the taxonomists have been unable to differentiate. All observations indicate that these insects reproduce viviparously on their available hosts throughout the winter season.

After completion of tobacco harvest in July, conditions become very unfavorable for aphids on any of the tobacco stalks remaining in the fields. The shade cloths are removed from the shade fields, and the occasional tobacco plants with depleted foliage surviving cultural operations are subjected to the direct rays of the sun and to insect enemies. Climatic conditions, disease, lady beetles, syrphid flies, mirids, and other insect enemies help to reduce aphids on tobacco. The mirid, *Cyrotopeltis varians* (Dist.), which is very numerous on tobacco at this season of the year, appears to be mainly responsible for the decline in the population. Under prevailing conditions the numbers become so depleted that specimens can very rarely be found on tobacco by the end of September. Volunteer and sucker to-

bacco plants are normally eliminated in northern Florida and in Georgia by freezing weather during the winter months, and this fact alone precludes the probability of the green peach aphid overwintering on this host plant.

Turnips, collards, and cabbage are the main reservoirs of the green peach aphid in the territory during the winter months. These crops are grown commercially on a moderate acreage and are available to the insect in many home gardens scattered throughout the tobacco-producing area. These crucifers normally survive any freezes in this latitude.

Tests were made to obtain information on alternate host plants. Aphids, definitely identified as green peach aphids, that had developed many successive generations on tobacco during the 1948 growing season were transferred to small turnip, collard, and cabbage plants in aphid-tight cages. The plants had previously been treated with insecticides to insure their freedom from aphids and their natural enemies. Infestations developed readily on all three plantings, with the heaviest populations on the turnips. After a seven-weeks' period aphids from each of the three crucifers were transferred to young tobacco plants free of insects and protected by tight cages. Heavy infestations developed on the tobacco in each case. Stunting of the plants was an obvious attestation of the continued virulence of these aphids.

It is evident from these tests that the green peach aphid can alternate between tobacco and cruciferous plants in this area and that cultivated crucifers are the most probable overwintered source of infestations in tobacco plant beds.

RESEARCH REQUEST

Dr. Erik Tetens Nielsen is conducting an investigation of the migratory habits of *Ascia monuste* (L.), the Great Southern White, and he is very anxious to obtain any information on the subject that may be available. Anyone having such information is requested to contact Dr. Nielsen at the Archbold Biological Station, Lake Placid, Florida.

BIOLOGICAL NOTES ON ANAGYRUS ANTONINAE TIMBERLAKE (HYMENOPTERA-ENCYRTIDAE) AND ITS HOST ANTONINA GRAMINIS (MASKELL) (HOMOPTERA-COCCIDAE)

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The first record of the Rhodes grass scale, *Antonina graminis*, in the United States is November 17, 1942. Nick R. Diaz, Agronomist for the King Ranch and at that time with the United States Department of Agriculture, Nursery Division of the Soil Conservation Service, collected specimens from Rhodes grass near Kingsville, Texas. The specimens were identified by Dr. Harold Morrison of the Bureau of Entomology and Plant-Quarantine. Dr. Morrison reported that this was the first record of the species from continental North America.

The Rhodes grass scale was first brought to the attention of the Texas Agricultural Experiment Station in November 1945. Dr. F. L. Thomas, then Chief, Division of Entomology of the Texas Agricultural Experiment Station, made surveys of the infested areas in December, 1945, and in July, 1948. Dr. Thomas concluded in his report of the surveys that, "The destruction of good stands of Rhodes grass in South Texas in less than three years where the grass is subjected to reasonable grazing or cutting for hay and infested with the scale shows without any doubt that the Rhodes grass scale *Antonina graminis* (Maskell) is a pest of major importance in Texas where grass is concerned." Quoting Robert J. Kleberg, President of the King Ranch, Dr. Thomas further reports: "Rhodes grass pastures formerly contributed good grazing for six to ten years after planting. Since 1940 there seems to have been a decided and rather abrupt change in the ability of Rhodes grass to survive more than three years". In his 1948 report Dr. Thomas observed one particular area of 50,000 acres where a good stand of Rhodes grass observed at the time of his 1945 survey, was at the time of his 1948 survey completely changed. In 1945 the scale had spread over a large portion of the area and considerable dead grass was present. By 1948 very few patches of Rhodes grass could be found in the area.

The following list of grasses, taken largely from Dr. Thomas' report, have been found infested with *Antonina graminis*. The grasses in this report were identified by Nick R. Diaz. The rec-

ord from sugar cane was furnished by Mr. W. K. Clore. A bunch of the cane growing in his yard at Harlingen, Texas, was killed by the attack of the scale.

Andropogon littoralis
Andropogon saccharoides
Bouteloua filliformis
Bouteloua hirsuta
Brachiaria ciliatissima
Buchloe dactylon
Cenchrus pauciflorus
Chloris gayana
Chloris ciliata
Chloris cucullata
Cynodon dactylon
Digitaria decumbens
Digitaria yunyoni
Elyonuras tripsacoides
Eragrostis secundiflora
Panicum halli
Paspalum plicatulum
Paspalum solitarium
Saccharum officinarum
Setaria geniculata
Setaria sp.
Sorghum halepense
Sorghum sp.
Sorghum sp.
Stenotaphrum secundatum
Trachypogon montufari
Trichloris puriflora
Triodia albescens
Vaseyochloa multinervosa

Zimmerman (3) gives the following host from Hawaii: aerial roots of sugar cane

Chloris sp.
Cynodon dactylon
Panicum spectabile
Panicum torridum
Panicum variegatum
Paspalum sp.
Pineapple roots.

Dr. Thomas made the following recommendation in his final report: "Because of the abundance of Rhodes grass scale in South Texas, the wide spread area which it covers, the large number of hosts attacked and the apparent lack of natural enemies, it is imperative that a complete research program in cooperation with the Bureau of Entomology and Plant Quarantine be initiated."

The biological control work was started at the Texas Agricultural Experiment Station, Substation No. 15 at Weslaco, in January, 1949, where the following native parasites were reared from Johnson grass infested with the scale:

Encyrtidae
Xanthoencyrtus sp. Determined by A. B. Gahan
Braconidae
Orgilus gelechiavorus Cush. Determined by C. F. W. Musebeck
Cynipidae
Charips sp. Determined by L. H. Weld
Chalcidoidae
Meromyzobia sp.
Meromyzobia sp.
Polynema logipes (Ash). All Determined by A. B. Gahan

Working with Mr. C. P. Clausen, in Charge of the Division of Foreign Parasite Introduction, Bureau of Entomology and Plant Quarantine, Dr. D. W. Clancy collected the parasite *Anagyrus antoninae* Timberlake in Hawaii for introduction into this area. The first shipment of parasitized scale was received on March 7, 1949. The parasites were reared out and introduced on *Antonina graminis* in the Insectary for multiplication.

A secondary or hyperparasite, *Marietta graminicola* Timb. was reared from the parasitized scale received from Hawaii.

The parasite *Anagyrus antoninae* was reared in the insectary on *Antonina graminis* infesting Johnson grass. Flats 18" x 18" x 6" with an 18" x 18" x 18" cage covered with 60 mesh per inch plastic screen were used for propagating the parasites. Johnson grass crowns infested with the scale were clipped to approximately three inch lengths and set in moist soil in the flats. The parasites were released in cages for oviposition. A few days before the new generation of parasites were due to emerge, the grass stems bearing the parasitized scales were placed in emergence boxes. These boxes were 6" x 6" x 15". The bottom and ends were constructed of ordinary ¾" pine lumber. The top and two sides were covered with black cloth. The lid was hinged to one side with the cloth. A hole 1½" in one end of the emergence box was fitted with a cork in which a hole was bored of sufficient size for the open end of a shell vial 23 x 83 mm. to fit snugly. As the parasites emerged and were attracted to the light in the vial they were removed and placed in extra large test tubes where they were fed a mixture of honey and water applied on a leaf in a hair streak.

In making detailed observations, a portion of a Johnson grass stem bearing Rhodes grass scale was placed in a shell vial with parent parasites for observation.

LIFE HISTORY

Anagyrus antoninae Timberlake

There is very little published information on *Anagyrus antoninae*. The species was described by P. H. Timberlake (2) in 1920 from Hawaii. He states that it was presumably introduced into Hawaii with the host years before from some part of the Orient. Zimmerman (3) lists *Anagyrus antoninae* under parasites of *Antonina graminis* with no comments.

THE EGG: The egg is transparent when laid and oval in form, approximately .20 mm. in length (Figure A). The surface

is shiny and without sculpturing. As the egg is oviposited, it retains a portion of the ovariole pedicel of about one-half to one-third the length of the egg proper. It lies free among the egg mass of the host without any attachment to the body wall of the host. At room temperature in late spring and early summer the egg hatches in three to four days.

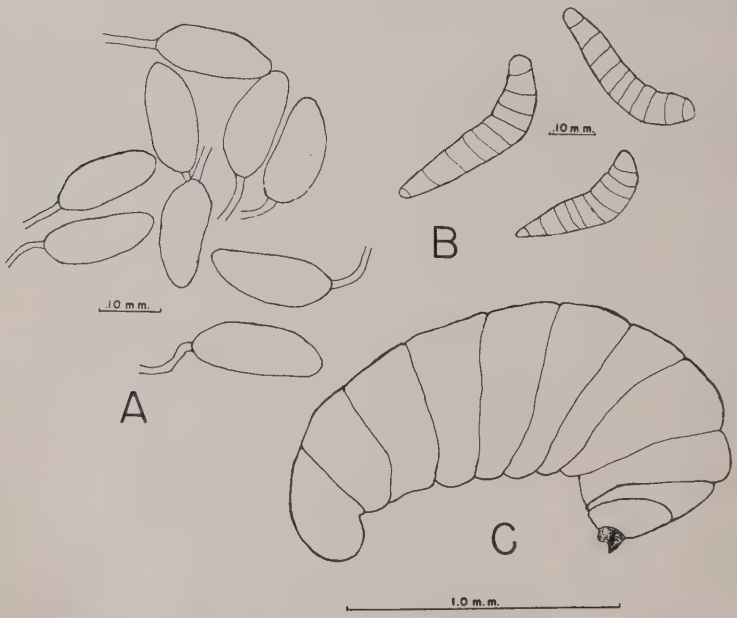
THE LARVA: The newly hatched larva is about .40 mm. in length when extended, white in color with distinct segmentation. (Figure B). After the larva has fed, the brownish content of the digestive tract gives the larva a darker color. Apparently most, if not all, of the feeding was on the eggs of the host. The fully developed larva is white in color with the reddish-brown content of the digestive tract showing in the central portion of the body. The larvae vary considerably in size with the average length of 1.75 mm. The width in proportion to the length increases as the larva develops. (Figure C). At this stage the usual holopneustic type of tracheal system is evident. The larva will continue to feed on the eggs of the host after the host is dead, if maturity is not reached before the death of the host.

THE PUPA: When the pupae stage is first reached, it is pure white in color; the eyes show pigmentation first, followed by a general darkening of the body. The pupa is loosely inclosed in a thin, brown parchment-like membrane within the body of the host.

THE ADULT: Emergence is normally accomplished by cutting a circular hole in the posterior-dorsal end of the body of the host. Mating takes place within a short time after emergence. Oviposition may also take place shortly after emergence, at least within an hour. The female will oviposit irrespective of mating. When reproduction is parthenogentic, the progeny are exclusively males. Under laboratory conditions the normal ratio of females to males is about equal; however, in some instances, when placed immediately after emergence into cages with host, the number of male progeny was greater proportionally due to the lack of some females being fertilized.

OVIPOSITION: The female makes a nervous examination of the prospective host by tapping with the antennae. Any live, gravid host apparently is satisfactory. If the individual host is found satisfactory, the female turns around and inserts the ovipositor. During the period of oviposition the wings are held in the normal position flat on the body with the antennae close

together and extended forward. Under laboratory conditions oviposition in the same individual may occur repeatedly. The female may leave the host and wander about a short time then return and oviposit again in the same host. The average number of eggs found in gravid females was 50. The minimum length of time elapsed from oviposition until emergence was 15 days under room temperature in summer, and the maximum time was 30 days at early spring temperatures. The average time was 18 to 19 days. Male individuals are the first to emerge.



Camera lucida drawings of immature stages of *Anagyrus antoninae* Timberlake

A. Eggs as they are deposited in the host
B. Larvae immediately after hatching
C. Mature larva

REFERENCES

1. Timberlake, P. H. 1920. Descriptions of new genera and species of Hawaiian Encyrtidae (Hymenoptera), II. Proc. Hawaii Ent. Soc. 4(2): 490.
2. Thomas, F. L. 1945 and 1948. Unpublished reports.
3. Zimmerman, E. C. 1948. Insects of Hawaii, Vol. 5. Homoptera: Sternorhyncha p. 156.

THE AQUATIC AND SEMIAQUATIC HEMIPTERA OF NORTHERN FLORIDA. PART 1: GERRIDAE.

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The aquatic and semiaquatic Hemiptera like so many other groups of insects have been neglected in Florida. Because of this my interest was stimulated and I began an investigation of the group which has extended over the period of 1946 through 1949. During the course of the study much information on taxonomy, distribution, and life histories has been collected. It is my intent to publish this information from time to time in the series "The Aquatic and Semiaquatic Hemiptera of Northern Florida." The earlier papers will include annotated lists of the various families; the last will present a classification of habitats in northern Florida as well as a key to species.

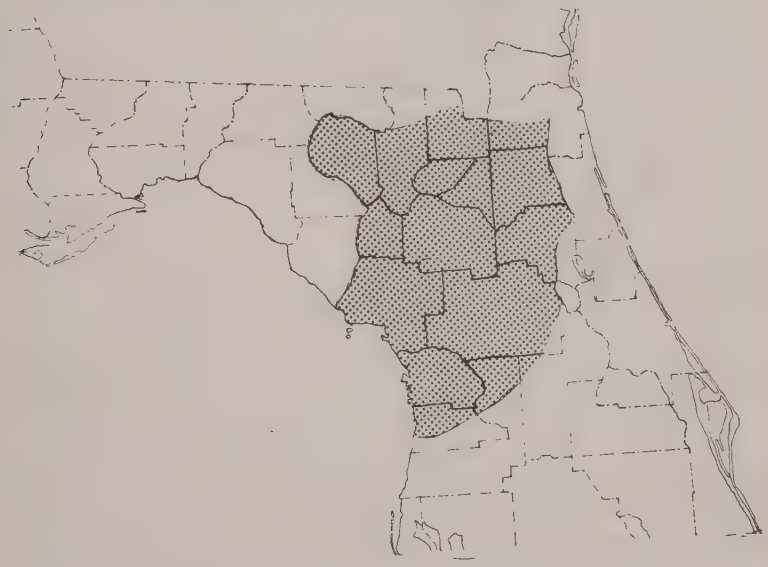


Figure 1. Map of Florida showing the area where collections were made.

The area where collections were made is bounded roughly by the Suwannee River and St. Mary's River to the north, the Weekiwachee and Ocklawaha rivers to the south, and the St.

Johns and Suwannee rivers on the east and west respectively (Figure 1). Some of the localities were visited many times, owing to their proximity to Gainesville, and others, more difficult of access, were visited only a few times. In addition to the material collected by me, certain specimens collected by others have been included in the study.

FAMILY GERRIDAE

Genus GERRIS Fabricius

Gerris canaliculatus Say

Almost every conceivable aquatic habitat teems with specimens of *canaliculatus*. It occurs in the dark, still waters of cypress swamps, the cool, clear, calcareous streams and in the swiftly flowing, sand-bottomed creeks. It seems to reach its peak of abundance in the latter habitat as do most of the other members of the genus *Gerris*. Hardly any type of habitat is without this species. It may be seen on the thick algal mats common in Nymphaea marshes, the roadside ditches which are densely overgrown with vegetation, and on the still waters of the sand-bottomed and hammock-region lakes. Bueno (1923) says that this form is rather rare in the northern states, where it frequents secluded little coves and bays in ponds. Only the nymphs in Florida appear to prefer the more secluded margins and coves of ponds and streams.

On April 30, 1948, I collected approximately one dozen males and females of this species from San Felasco Hammock Pond and placed them in a twenty-gallon aquarium. They appeared to be a little disturbed by the trip and spent several minutes brushing their legs together in order to remove the excess water that had splashed over them in transit. In the late afternoon, one pair was observed in copulation. The male encircled the thorax of the female with his anterior legs and extended his middle legs at right angles to his body, with his entire weight borne by the female. She seemed hardly aware of this and skated blithely about feeding on coccinellid beetle larvae which were thrown into the water. At times she would brush violently at the forelegs of the male in an attempt to free herself. Copulation lasted for approximately twenty minutes, with the female finally freeing herself by raising almost vertically on her posterior legs and brushing the male loose with her front legs. He jumped several inches into the air and bounded

away to the corner of the aquarium. The female rested for several minutes on a leaf of frogbit (*Limnobium spongia*). Another pair of *Gerris canaliculatus* was observed later in the evening in copulation which lasted for thirty minutes.

Coccinellid beetle larvae were the chief foods offered to the gerrids during the period that they were under observation. Rafts of mosquito eggs were placed in the aquarium and panes of window glass were used to prevent the emerging mosquitoes from escaping. The gerrids, however, cared very little for mosquitoes and were never observed attacking the larvae or pupae as they came to the surface for air. Adult mosquitoes were taken as food only when no beetles (adults, pupae or larvae) were offered for long periods of time. Most of the coccinellid larvae were nearly as large as the gerrids, but this was no obstacle for the water striders. One would skate up to a struggling larva, stab it with its beak, skate away and return from the other side to attack again until the larva's struggle had almost ceased. Then it would gorge itself on the body fluid until it was almost cylindrical. On several occasions, adults were observed attacking small snails that were creeping along under the surface film. At every stab, the snail would withdraw its foot. Finally, the gerrid gave up and skated away. Many times beetle pupae were picked up by the front legs of the strider and carried about until their body juices had been completed exhausted. Once, a gerrid captured a mosquito that was just beginning to emerge from its pupal skin.

The first eggs were discovered on May 5. Since mating had occurred repeatedly since April 30, it was not possible to determine how long after copulation the eggs were laid. The eggs were discovered on the underside of a frogbit leaf that floated on the surface of the water. They were arranged in long rows along the periphery of the leaf blade. Some were mottled with brown spots; others were chalky white. In many of the mottled eggs, the red eyespots of the developing nymph were already visible. All of the eyespots in these and the dozen of other eggs discovered, were at the end of the egg next to the periphery of the leaf. The eggs varied in length from 1.13 to 1.19 millimeters, and varied in width at the widest point from .298 to .375 millimeters.

After the eggs were laid, they remained milky white for at least fifteen hours. They then began to mottle with brown and were very speckled twenty-four hours later. In another thirteen

hours the brilliant red eyespots were visible and shortly prior to hatching, an egg-burster could be seen through the shell.

The eggs hatched in a little less than six days after they were laid. The egg suddenly split longitudinally for half of its length. The nymph probably aided the process by using the small triangular egg-burster, although no movement of the nymph inside was observed until the egg split open. Following this, the nymph slid half of the body into view still enclosed in the embryonic membrane, which bore the egg-burster on its anterior end. This membrane split before the nymph was completely out and the struggling nymph emerged from the shell and the membrane at the same time. After the nymph had freed itself, it struggled violently to reach the surface film. In most cases, this initial struggle was futile and the young gerrid fell to the bottom, remaining there for five or ten minutes before making another attempt to reach the surface. Some nymphs were rescued from the bottom of the aquarium; they were still alive after they had remained there for forty-five minutes.

Fatality rate was very high among the newly hatched young. They refused almost all food that was given to them, but feasted upon their dead companions. Out of approximately sixty that hatched, only one was raised to maturity. This single male passed through five instars, each of about three days duration, and reached maturity on June 4. The total time from egg to adult was thirty days.

Hibernation does not occur in Florida due to the relatively mild winters. Adults have been collected in every month of the year and nymphs have been taken in January, February, April, May, September and December. It appears that breeding occurs throughout most of the year.

SPECIMENS EXAMINED: *Alachua Co.:* Santa Fe River, 200 yards east of Poe Springs, May 8, 1947,1♂, 5 nymphs; Poe Springs, May 14, 1934, R. Rubin 1♂; Lake Santa Fe, December 2, 1947, 7♂♂, 3♀♀, 6n; December 4, 1947, 2♂♂, 1♀, 4n; Blues Creek, 6 miles northwest of Gainesville, September 21, 1947, 6♂♂, 2♀♀, 5n; February 3, 1948, 9♂♂, 4♀♀, 1n; Twin Oaks Pond, November 23, 1947, 5♂♂, 4♀♀; May 14, 1948, 2♀♀, 1n; Biven's Arm of Payne's Prairie, March 30, 1946 W. Beck 2♀♀; April 13, 1946, W. Beck 1♀; October 12, 1946 W. Beck 1♀; October 22, 1946 W. Beck 1♀; November 5, 1946 W. Beck 1♀; Hailes Siding Pond on Payne's Prairie, November 23, 1947, 2♂♂, 3♀♀; west branch of Hogtown Creek, February 3, 1948, 4♂♂, 2♀♀; Hogtown Creek at the sink, March 14, 1933 collector unknown 1♀; April 24, 1937 F. N. Young 1♂, 1♀; March 13, 1947, 16♂♂, 12♀♀; May 1, 1947, 7♂♂, 2♀♀, 2n; San Felasco Hammock Pond, October 28, 1947, 1♀; Big Hatchet Creek,

February 27, 1947 I. J. Cantrall et al 1♂, 1♀; Green Sink, Campus of University of Florida, December 30, 1947, 7♂♂, 11♀♀; River Styx, 6 miles southeast of Gainesville, January 31, 1948, 1♂, 2n; Big Orange Creek, January 18, 1948, 4♂♂, 9♀♀, 8n; roadside canal, R.20E., T.8S., S.17, February 7, 1948, 1♂, 1♀; cypress-gum swamp, 5 miles southeast of Gainesville, January 31, 1948, 2♂♂, 3♀♀; Pond "A", Sugarfoot Hammock, 4 miles west of Gainesville, August 17, 1946, 1♂, 3♀♀; Pond "C", 3 miles southwest of Gainesville, May 18, 1933 J. Kilby 1n; April 4, 1933 J. S. Rogers 1♂, 2n; Devil's Millhopper, 5 miles northwest of Gainesville, September 16, 1947, 1♂, 1♀; Rocky Creek, 8 miles north of Gainesville, February 7, 1948, 3♀♀; Scott Prairie, R.19E., T.7S., S.35, 2♂♂, 2♀♀. *Dixie Co.:* Little Fannin Springs, May 23, 1947, 3♂♂, 2♀♀, 2n. *Hernando Co.:* Salt Creek, 2 miles east of Bayport, January 29, 1948, 1♀; Mark 20, 1948, 1♂; May 22, 1948, 3♂♂, 4♀♀; June 20, 1948, 1♀. *Levy Co.:* Otter Creek, May 22, 1948, 1♂; hammock stream, 3 miles east of Cedar Key, December 31, 1947, 1♂, 1♀, 6n. *Marion Co.:* Sweetwater Springs, 1 mile southwest of Juniper Creek bridge, July 3, 1948 G. K. Reid, Jr. 8♀♀; Temporary pool near Eureka, February 12, 1938 Collector Unknown 2♂♂, 1♀, 2n. *Putnam Co.:* Little Orange Creek, January 18, 1948, 11♂♂, 14♀♀, 4n; gum swamp on St. Johns River, 8 miles north of Palatka, August 24, 1948, 1♂; roadside ditch in flatwoods, 8 miles north of Palatka, August 24, 1948, 1♀.

Gerris nebularis Drake and Hottes

G. nebularis, the largest of the Florida gerrids, prefers the swift flowing, sand-bottomed creeks. It has been taken occasionally in the calcareous streams and rarely in sinkholes and fluctuating hammock ponds. It may be seen coursing the more shaded areas of the sand-bottomed creeks. It usually may be found most readily underneath bridges. In these situations, it is wary, keeping just out of reach of a dip-net and taking wildly to the open when suddenly alarmed.

The life history of *Gerris nebularis*, described in 1925 from material collected at Hogtown Creek, is unknown. Since that time, there have been no published life history observations on this species. Because of size and food requirements, it does not take well to laboratory rearing. In general, the larger gerrids require a longer period of time for incubation and maturity. As in the case of *canaliculatus*, the time required is more than likely several days to a week shorter than the time required in the cooler climate of the North. There are five instars in the other members of the genus; it should not vary in this form.

I have collected adults throughout most of the year. Nymphs have been taken along the more secluded areas of streams in February, April and May.

Food consists largely of winged insects that alight upon or fall into the water. At Little Orange Creek, I fed individuals of *nebularis* by killing deer-flies and throwing them upon the surface of the water. The adults skated close to me to retrieve the flies and then glided away, carrying the prey on their beaks.

SPECIMENS EXAMINED: *Alachua Co.:* Hogtown Creek, 200 yards south of Michigan Avenue, April 24, 1937 F. N. Young 1♀, 1n; Hogtown Creek at Michigan Avenue, October 5, 1932 collector unknown 1♀; Santa Fe River near Poe Springs, May 8, 1947, 1♂, 1♀, 4n; Santa Fe River at Worthington Springs, February 6, 1949, 1♂; Rocky Creek, 8 miles north of Gainesville, February 7, 1948, 4♂♂, 1♀; Pond "C", 3 miles southwest of Gainesville, March 9, 1933 collector unknown 3♂♂, 6♀♀; Santa Fe Sink, April 8, 1947 G. K. Reid, Jr. and H. G. Dowling 2♂♂. *Bradford Co.:* Sampson River, February 6, 1949, 5♂♂, 9♀♀. *Dixie Co.:* Little Fannin Springs, May 23, 1947, 10♂♂, 8♀♀, 5n. *Levy Co.:* Otter Creek, May 22, 1948, 3♂♂, 3♀♀. *Marion Co.:* temporary pool near Eureka, February 12, 1938 collector unknown 1♂. *Putnam Co.:* Little Orange Creek, May 22, 1947, 3♂♂, 1♀, 1n.

Genus LIMNOGONUS Stal

Limnogonus hesione (Kirkaldy)

This little water strider prefers the quieter lakes and ponds of the area. It has been taken in great numbers from Nymphaea marshes, sinkholes and vegetation-filled, roadside ditches. *Limnogonus hesione* is not abundant in the larger or swifter streams but frequents, most commonly, the smaller ditches and fluctuating ponds. On several occasions, it has been taken from calcareous streams and sand-bottomed creeks. It is quite frequently macropterous and probably flies to more permanent bodies of water when the roadside ditches or other temporary habitats disappear. Drake (1915) states that the long-winged form is rare in the North.

Drake described the life history of this species. The eggs are laid just below the surface of the water on the underside of sticks and leaves. Many individuals remain *in coitu* for several days. One pair which I brought into the laboratory was observed to be in almost continuous copulation for an entire day. The female of this pair had one posterior leg missing except for a small part of the femur. The lack of this leg caused the female considerable difficulty in supporting the male during coitus.

The eggs are somewhat enlarged at one end and about three times as long as wide. They vary in length from 1.00 to 1.33 millimeters, and are a dirty greenish yellow which becomes dark-

er with age. As the nymph emerges, the membrane (termed chorion, by Drake) is split longitudinally over one-half of its length. The nymph passes through the usual five instars. In Ohio, the adult stage was reached fifty days after hatching.

I have taken adults in April, May, July, August, September, October, November and December. Nymphs were taken in April, September, October and November.

The food of *L. hesione* consists of small insects that fall into the water. Drake (1915) says that if there are no living victims, then they do not disdain dead and decaying material.

SPECIMENS EXAMINED: *Alachua Co.:* Biven's Arm of Payne's Prairie, April 2, 1946 W. Beck 2n; April 23, 1946 W. Beck 1n; October 22, 1946 1♀; August 12, 1947, 1♀; sinkhole, 3 miles southeast of Gainesville on Pearl Street Road, October 17, 1934 H. T. Townsend 1♂, 1♀, 1n; November 27, 1934 H. T. Townsend 3♂♂, 2♀♀; December 18, 1934 H. T. Townsend 1♂, 2♀♀; September 27, 1937 S. H. Spurr 1♂, 2♀♀, 2n; Santa Fe River near Poe Springs, May 14, 1934 H. T. Townsend 2♀♀; May 8, 1947, 6♂♂, 6♀♀; Freezer's Pond, 2 miles northwest of University of Florida, May 7, 1938, collector unknown 1♂; August 1, 1946, 1♂; Pond "B" in Sugarfoot Hammock, October 21, 1947, 3♂♂, 3♀♀; Lake Wauberg, April 30, 1938 collector unknown 2♀♀; Lake Alice, May 24, 1938 S. H. Spurr 1♀; Hogtown Creek at Hogtown Sink, May 16, 1947, 3♂♂, 3♀♀. *Citrus Co.:* drainage ditch, 8 miles north of Homosassa Springs, November 2, 1947, 2♂♂, 2♀♀, 1n. *Dixie Co.:* Little Fannin Springs, May 23, 1947, 1♂, 5♀♀. *Hernando Co.:* Salt Creek, 2 miles east of Bayport, April 25, 1948, 1♂.

Genus METROBATES Uhler

Metrobates hesperius depilatus Hussey and Herring

Calcareous streams are the only habitats from which *M. h. depilatus* has been taken. Here, they form compact schools of thousands of individuals. The water is literally covered with adults and nymphs. They are swift runners on the surface film and tend to congregate over the deeper pools where it is difficult to collect them unless one has a boat. Wielding tea strainers from a motor boat, Dr. John Kilby and I collected well over one-thousand specimens in a few minutes on the Weekiwachee River on July 18, 1948. At Salt Creek, I collected many specimens by using a D-net and wading into the deeper pools where the striders were congregated.

Very little is known about the life history of *depilatus* or the other forms of *Metrobates*. I have collected adults in January, March, April, May, June, July and November. The adults were accompanied by nymphs in March, June and July.

Drake and Harris (1932:84) state, "For food, they [the members of the genus, as a whole] prey largely upon insects, which chance to fall into the water. Very little is known regarding the breeding and hibernating habits and life-cycle of the members of the genus."

All of the specimens of *depilatus* are apterous. Alate individuals of *hesperius* are found occasionally. In the genus *Metrobates*, as well as in a number of genera of Gerridae, the wings are frequently mutilated, being broken off near their bases by the insects themselves.

SPECIMENS EXAMINED: *Hernando Co.:* Salt Creek, 2 miles east of Bayport, January 29, 1948, 4♂♂, 3♀♀; March 20, 1948, 5♂♂, 9♀♀, 15n; April 25, 1948, 48♂♂, 49♀♀; May 22, 1948, 3♂♂, 2♀♀; June 20, 1948, 4♂♂, 9♀♀, 11n; Weekiwachee River at the springs, July 18, 1948, 198♂♂, 198♀♀, 691n; November 1, 1947, 1♂.

Metrobates hesperius ocalensis Hussey and Herring

This form is known only from the type material collected at Rainbow River in Marion County. In a recent paper (1949), Hussey and Herring erroneously placed this river in the Ocala National Forest. It is located in the southwest corner of the county, approximately one mile from Dunnellon. It is also worth noting that in the key to the males in this paper, couplet 3 leading to *M. hesperius depilatus* which reads, "legs as in the subspecies immediately preceding", should be corrected to read, "legs as in *M. hesperius ocalensis.*"

Metrobates anomalus comatipes Hussey and Herring

This subspecies is known from only two counties in Florida. I took *comatipes* in Little Orange Creek, a sand-bottomed stream in Putnam County; the other locality is a calcareous stream located in Marion County. Nymphs were taken in May and July.

SPECIMENS EXAMINED: *Marion Co.:* Sweetwater Springs, 1 mile southwest of Juniper Creek bridge, July 3, 1948, G. K. Reid, Jr. 19♂♂, 17♀♀, 23n. *Putnam Co.:* Little Orange Creek, May 22, 1947, 6♂♂, 1♀, 2n.

Genus TREPOBATES Uhler

Trepobates pictus (Herrich-Schaeffer)

T. pictus appears to be one of the rarest of the north Florida water striders. I have collected it only at Rainbow River, a calcareous stream in Marion County. Two males and one nymph were taken in company with several *Rheumatobates tenuipes* and numerous individuals of *Metrobates hesperius ocalensis.*

The only Florida record in the literature is that of Uhler (1884), "Massachusetts to Florida."

Hungerford (1919) has worked out the life history of this form in Kansas. He found that the egg masses are laid in a gelatinous material on the underside of leaves and sticks in the water. Three to ten eggs are laid in each mass. They are white at first but become beautifully mottled with small dots before hatching. Nymphs hatched five days after the eggs were laid.

Like the other gerrids, the members of this genus are all predaceons, feeding upon small insects.

SPECIMENS EXAMINED: *Marion Co.:* Rainbow River, August 4, 1946, 2♂ ♂, 1n.

Genus RHEUMATOBATES Bergroth

Rheumatobates rileyi Bergroth

R. rileyi lives on the slower-moving stretches of the sand-bottomed and calcareous streams where it usually forms compact little schools over the deeper portions.

On May 17, 1948, I collected about fifty specimens from Hogtown Creek, near Gainesville, and brought them into the laboratory. When they were brought in, several of them were dead and the surviving individuals immediately feasted upon the dead bodies. During their brief laboratory life of two weeks, they devoured small moths, psychodid flies and ants. They refused to touch a dead roach that was placed on the surface of the water. Silvey (1931) states that they catch small ostracods through the surface film and run about continually with the small crustaceans on the end of their upturned beak until all of the usable material is removed from the body of the ostracod.

The amount of time required to pass from egg to adult is unknown. Silvey (1931) has published an interesting study of the life history of this form but he does not mention any time relationships.

SPECIMENS EXAMINED: *Alachua Co.:* Hogtown Creek, near the sink, May 16, 1947, 8♂ ♂, 27♀ ♀, 19n; May 17, 1947, 6♂ ♂, 38♀ ♀, 3n. *Dixie Co.:* Little Fannin Springs, May 23, 1947, 1♂, 1♀.

Rheumatobates tenuipes Meinert

Like *rileyi, tenuipes* lives on the surface of the swift-flowing streams. It has been taken from the deeper pools of the calcareous and sand-bottomed creeks. The following is from my field notes: "On the 16th and 17th of May, 1948, both species of *Rheuma-*

tobates were collected at Hogtown Creek, approximately ½ mile east of Hogtown Sink. They were observed in large groups in the center of the stream where the current was sluggish and the creek was deeper, as well as wider, than at any other point in the vicinity. This deep pool was separated from the remainder of the creek by a barrier of water hyacinths *(Piaropus crassipes)* on the west and another barrier formed on the east by the creek suddenly becoming narrow and very swift. Further collecting failed to reveal these species at any other spot along the creek." At Little Fannin Springs, numerous individuals were collected at the mouth of the springs under conditions similar to those described above. On one occasion, specimens were collected in a quiet cypress swamp.

The life history is probably quite similar to that of *rileyi*. The eggs are inserted in the stems and leaves of aquatic plants.

SPECIMENS EXAMINED: *Alachua Co.:* Hogtown Creek near the sink, May 16, 1947, 2 ♂ ♂, 1 ♀; May 17, 1947, 1 ♂, 4 ♀ ♀. *Dixie Co.:* Little Fannin Springs, May 23, 1947, 15 ♂ ♂, 65 ♀ ♀, 24n. *Hernando Co.:* Salt Creek, 2 miles east of Bayport, November 1, 1947, 1 ♂, 1 ♀, 2n; January 29, 1948, 16 ♂ ♂, 27 ♀ ♀, 25n; March 20, 1948, 5 ♂ ♂, 26 ♀ ♀, 5n; May 22, 1948, 3 ♂ ♂, 7 ♀ ♀, 1n; Weekiwachee River near the springs, July 18, 1948, 53 ♂ ♂, 58 ♀ ♀, 8n. *Marion Co.:* Rainbow River, August 4, 1946, 1 ♂, 1n. *Putnam Co.:* gum swamp on St. Johns River, 8 miles north of Palatka, June 6, 1947, 10n.

LITERATURE CITED

Drake, Carl J. 1915. See Osborn, Herbert and C. J. Drake 1915.

Drake, Carl J. and H. M. Harris. 1932. VI. A synopsis of the genus *Metrobates Uhler*. Annals Carn. Mus. 21 (2): 83-88, 1 fig.

Hungerford, H. B. 1919. The biology and ecology of aquatic and semi-aquatic Hemiptera. Kans. Univ. Sci. Bul. 2 (17): 1-341, 32 pl.

Hussey, Roland F. and Jon L. Herring. 1949. Notes on the variation of the *Metrobates* of Florida (Hemiptera, Gerridae). The Fla. Ent. 32 (4): 166-170.

Osborn, Herbert and Carl J. Drake. 1915. Additions and notes on the Hemiptera-Heteroptera of Ohio. Ohio Nat. 15 (7): 501-508.

Silvey, J. K. Gwynn. 1931. Observations on the life-history of *Rheumatobates rileyi* (Berg.). Pap. Mich. Acad. Sci. 13: 433-447.

Torre-Bueno, J. R. de la. 1923. The Reduviidae and the families of semi-aquatic and aquatic Heteroptera. In: Part IV, the Hemiptera or sucking insects of Connecticut. Conn. State Geol. and Nat. Hist. Surv. 34: 391-421, 658-665, 674-692.

Uhler, P. R. 1884. Order VI. Hemiptera, Suborder III. Heteroptera. Standard Nat. Hist. 2: 249-296.

NYMPHS OF THREE SPECIES OF GOMPHUS. (ODONATA)[1]

MINTER J. WESTFALL, JR.

In 1897 Dr. J. G. Needham described from a single male taken at Gotha, Florida, April 21, 1897 by Mr. Adolph Hempel, a new species of Odonata which he named *Arigomphus australis*. There were no illustrations with the description. From the literature it would appear that until the present time this was the only adult specimen known. Later references in the literature by Byers, Muttkowski, and Needham all refer to this single holotype male.

The holotype of *Gomphus australis* is now in the Cornell University collection. It is in several parts; the end segments of the abdomen and terminal appendages are on a pin. The wings, penis and one pair of hamules are mounted on slides, while the base of the abdomen and the other pair of hamules are in alcohol. I have not been able to find the head and thorax, although they may be elsewhere in the collection.

The species was not figured until the *Handbook of Dragonflies of North America* appeared in 1929. The outline drawings of the appendages, dorsal and lateral, and of the hamules were made by Dr. C. F. Byers from the holotype. The same figures, altered only slightly, were reproduced by Dr. Byers in 1930 in his *Contribution to the Knowledge of Florida Odonata*. Since that time no further illustrations have appeared. In this paper I am presenting photographs of the hamules of the holotype and dorsal and lateral views of the end segments of the abdomen of a male taken by Mr. G. K. Scudder at Palm Springs, Florida and now in the author's collection.

In addition to this male I have in my collection a male taken in transformation at Lake Redbug in Seminole County, Florida, April 12, 1936 by Mr. J. A. Fluno. I also have several nymphs collected at the same lake by myself in the spring of 1948 and 1949. On March 28, 1949 Dr. J. G. Needham reared a male at Archbold's Biological Station near Lake Placid, Florida. He has kindly loaned me the specimen for study in preparing this paper.

The three males we now have in addition to the holotype appear to be all of the adults taken of this species. The original description seems to fit the three additional males quite well except for minor and variable details of color pattern.

[1] Contribution from the Department of Biology, University of Florida.

In our specimens the inner surfaces of the middle femora as well as of the front femora are pale. The middle segments of the abdomen may not be entirely black as mentioned in the description. Segment 3 is broadly yellow on the sides; the sides of segments 4 to 6 have bright yellow triangles at the anterior margins in teneral specimens, less conspicuous in the older male from Palm Springs. Segments 3 to 6 likewise have a narrow line of yellow on the dorsum, becoming less extensive with age as the darker pigmentation spreads. Not mentioned in any of the descripitons is the extreme hairiness of the end segments of the abdomen as shown in the accompanying photographs. Segment 9 in the adult as in the nymph is very long, segments 8, 9, and 10 comparing in length about as 7:10:4. In size the species measures: Length 52-53 mm.; abdomen 39-42; hind wing 27-29. As yet the female is unknown. This paper was delayed in the hope that we might rear a female from one of the nymphs collected.

The species *australis* was at first placed in *Arigomphus* by Dr. Needham but later moved to the subgenus *Gomphus* where it now remains. It is unique in this group in being the only one of our species with a cross-striped face. The long 9th segment is unusual also. The anterior hamule is sway-backed, the part above the shoulder long and tapered rather quickly to a point. The teeth of the anterior hamule are directed upward, not inward as in most species of this subgenus. These characteristics, and others, readily distinguish the adult from other members of the group, yet the nymph is remarkably like that of *cavillaris*, as will be seen from the accompanying photographs.

EXPLANATION OF PLATE

Figure 1. Labium of nymph of *Gomphus cavillaris* Needham.

Figure 2. Anterior and posterior hamules of holotype adult male of *Gomphus australis* Needham.

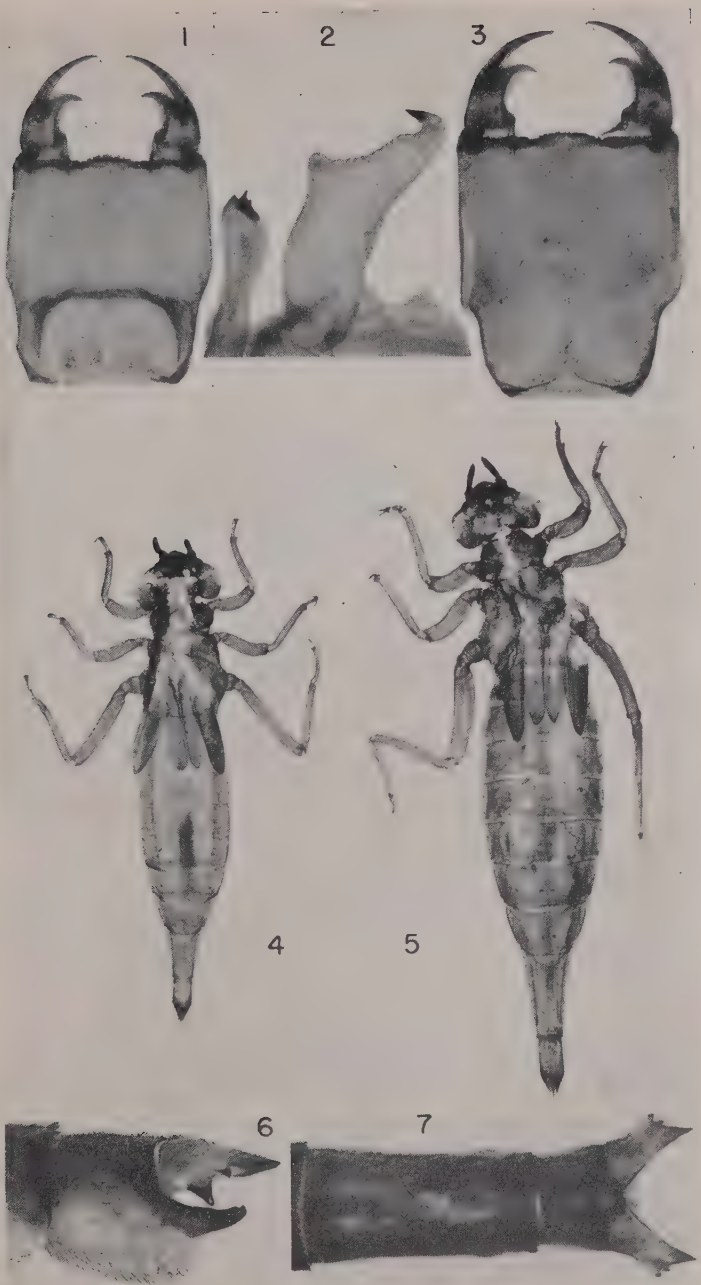
Figure 3. Labium of nymph of *australis* photographed to the same scale as that of *cavillaris*.

Figure 4. Exuviae of *cavillaris*.

Figure 5. Exuviae of *australis* photographed to the same scale as that of *cavillaris*.

Figure 6. Lateral view of segment 10 and appendages of adult male of *australis* collected at Palm Springs, Florida.

Figure 7. Dorsal view of segments 9 and 10 and appendages of the same male.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NYMPHS OF AUSTRALIS, CAVILLARIS, AND MINUTUS

The nymph of *australis* was described by supposition in 1901 by Needham and Hart. In comparing their description with reared specimens of *australis* it is apparent that the specimens upon which the description was based were of *cavillaris*. This was early suspected when the larger size of our reared specimen was noted and later confirmed when the author saw one of the original nymphs described as *australis*. Because of their striking similarity one must look carefully for characters to separate them.

The nymphs of *cavillaris* and *minutus* were likewise described originally by supposition in 1928 by Elsie Broughton. The descriptions are brief and hardly adequate to be certain that the specimens were attributed to the correct species. In 1930 Dr. Byers (1930, p. 62) stated with regard to his description of the supposed *minutus*, "This description does not agree with that given for the nymphs of *minutus* by Broughton, indeed it agrees more closely with her description of the nymph of *G. cavillaris*, differing, at least, however, in the number of lateral spines. On the other hand, the Broughton description of *G. minutus* agrees in all stated respects with Needham's description of *G. australis*. All of these descriptions are obviously inadequate and it remains for some student carefully to rear the nymphs of these three species—*australis, cavillaris* and *minutus*, but because of the extreme rarity of at least two of them this will be a long time in coming."

We now have reared specimens of all three of these species and it is therefore deemed wise to give here a more complete description of the three species and then to point out the important differences between them.

Gomphus australis Needham

Length 39 mm.; abdomen 27; hind femur 7; width of head 6; width of abdomen 8.

General color light brown; antennae, legs and lateral margins of abdomen quite hairy.

Head widest a little behind the middle of the eyes and decidedly narrower than the abdomen; postero-lateral angles of head swollen; hind margin only slightly excavated.

Hinge of labium extending back almost to base of procoxae; mentum contracted in the proximal 2/5, width by length about as 10:12, widest at front margin; anterior margin of mentum slightly convex, with about 16 to 20 flat scales almost hiding two minute teeth in the middle of the front

border. Lateral lobes stout, suddenly narrowed to form a strong incurved end hook, inside of which are 8 to 9 sharp, obliquely truncate, posteriorly directed teeth. Movable hook long, strong and incurved.

The depressed abdomen is widest on segment 4, tapering to the end, with segment 9 exceptionally long; this segment is about 5 mm. long, 3.2 wide at base and 2 at apex. Wing pads reach to base of segment 4.

No trace of a dorsal hook. When viewed dorsally there is no emargination of the posterior margins of the segments; from the side one sees slight elevations of these margins but no hooks. Lateral spines on 6 to 9, small on 6 but definitely present; that on 9 is only about 1/10 the length of segment 10. Superior and inferior appendages subequal, laterals about 9/10 as long. Relative lengths of segments 8, 9, 10, and appendages about as 6:10:4:3.

Young nymphs measuring 33 mm. in length have the wing pads small, reaching only to the middle of segment 2. Otherwise they are about the same as the full-grown nymphs.

Described from two reared nymphs, one from Lake Redbug in Seminole County, Florida, April 12, 1936, the other from Archbold's Biological Station near Lake Placid, Florida, March 28, 1949, and two smaller nymphs from Lake Redbug in April, 1948.

Gomphus cavillaris Needham

Length 29.5-30 mm.; abdomen 20-21; hind femur 6; width of head 5-5.2; width of abdomen 5-6.5.

General color light brown; antennae, legs and lateral margins of abdomen moderately hairy.

Head widest a little behind the middle of the eyes and about same width as abdomen; postero-lateral angles swollen; hind margin only slightly excavated.

Hinge of labium extending back to base of procoxae; mentum contracted in the proximal 2/5; width by length about as 10:11, widest about 2/5 of its length from base and narrowed very slightly forward. Front border of mentum is slightly convex with a dense brush of flat scales, narrower than those of *australis* almost hiding a small single, bifid, or double tooth in the middle. Lateral lobes stout, suddenly narrowed to form a strong incurved end hook, inside of which are 7 to 8 obliquely truncate, posteriorly directed teeth.

The abdomen is less depressed than in *australis*, almost cylindrical in exuviae; widest on 4 and tapering gradually to the end. Segment 9 is about 3 mm. long, 2.5 wide at base and 1.75 at apex. Wing pads reach back to base of segment 4.

No trace of a dorsal hook; occasionally a sharp, minute median tooth present on the apical margin of segment 9 as viewed from the dorsum; some of the anterior segments when viewed laterally show slightly elevated posterior margins. Lateral spines present on 7 to 9, thick, short and often incurved; no trace of a spine on 6 in any specimen observed; spine of 9 about 1/6 the length of segment 10. Superior and inferior appendages subequal, laterals about 8/10 as long. Relative lengths of segments 8, 9, 10 and appendages about as 7:10:5:4.

Described from four reared specimens from Lake Redbug, Seminole County, Florida, April 1949; Orlando, Florida, April 15, 1941; and Lake Placid, Florida, April 4, 1945; also two excuviae from Lake Sue, Winter Park, Florida and three nymphs from Swim Pond, Marion County, Florida, February 26, 1938.

Gomphus minutus Rambur

Length 29-30 mm.; abdomen 19-20; hind femur 6; width of head 5.5; width of abdomen 7.

General color dark brown; antennae, legs and lateral margins of abdomen very hairy.

Head widest a little behind the middle of the eyes and decidedly narrower than the abdomen; postero-lateral angles swollen; hind margin only slightly excavated.

Hinge of labium extending back to middle of procoxae; mentum contracted in the proximal 2/5, width by length about as 10:12, sides subparallel or converging slightly forward; anterior margin of mentum moderately convex, with a brush of flat scales, occasionally also with a pair of minute teeth in the middle. Lateral lobes stout with 6 to 7 shallowly excavated blunt teeth inside the end hook which is strong and incurved. In one specimen from Josephine Creek, near Lake Placid, Florida the teeth are about 8 in number and deeply excavated, quadrangular in form, decreasing in size toward the base so that the last one is difficult to ascertain, but otherwise the specimen seems to be the same as other specimens which are reared.

The depressed abdomen is widest on segment 4 or 5 and then tapers to the end. Segment 9 is about 3 mm. long, 3.5 to 4 wide at the base and 2 at the apex. Wing pads extend to a little beyond the base of segment 4.

Dorsal hooks might be overlooked, but when viewed dorsally the posterior margins of segments 7 to 9 are seen to have a very strong emargination not found in nymphs of *australis* and *cavillaris*. Segments 4 to 6 when viewed from the side show upward projecting humps but no emargination of the posterior margin. Lateral spines on 6 to 9, small on 6 but definitely present, usually sharper and less incurved than in *australis* and *cavillaris*; spine of 9 about 4/10 length of segment 10. Superior appendage is just a little shorter than the inferiors, the laterals a little shorter yet. Relative lengths of segments 8, 9, 10 and appendages about as 7:10:6:5.

Described from nymph collected in a ditch at Archbold's Biological Station and reared March 18, 1949 by Dr. Needham, also four other grown nymphs from the same ditch, two from Josephine Creek near Lake Placid, collected March 1948 and February 2, 1949.

In comparing our reared material of *cavillaris* with Broughton's description of that species, it is noted that there are several discrepancies. I have not seen a specimen with a median lobe of the labium so strongly convex as shown in her figure, nor lateral lobes with 10 teeth. No sign of dorsal hooks has been noted except as mentioned in our description, though her specimen had them.

Our reared specimens of *minutus* have what I would interpret to be dorsal hooks and Byers describes them in his specimens also, whereas Broughton's description says there are none. The size given for *minutus* in the Broughton description fits better the specimens we have of *cavillaris*. Her *minutus* had the abdomen 4.5 mm. wide and *cavillaris* 6.5. This is just the reverse of the situation in our reared material, *minutus* having a wider abdomen than *cavillaris*.

Since the nymphs Dr. Needham had at hand when describing the supposed *australis* have been shown to be *cavillaris*, the fact that the original description of *minutus*, as pointed out by Byers, agreed in all stated respects with the *australis* description it would seem likely that Broughton had *minutus* and *cavillaris* confused. It is also possible that she had nymphs of *G. brimleyi* or two closely allied species which Dr. Needham is now describing as new.

If one had only these three species before him he could separate the nymphs as follows:

1—Dorsal hooks (emarginations of the posterior margin of segments) present on 7-9; lateral spines of 9 almost half as long as segment 10; segment 9 shorter than its basal width ..... *minutus*

—Dorsal hooks absent; lateral spines of 9 not over 1/6 length of segment 10; segment 9 longer than its basal width 2

2—Length when grown about 39 mm.; abdomen decidedly wider than head; width by length of mentum about as 10:12, widest at apical border; segment 9 about 5 mm. long when grown..... *australis*

—Length when grown about 28-31 mm.; abdomen about as wide as head; width by length of mentum about as 10:11, widest point 2/5 distance from base to tip; segment 9 about 3 mm. long when grown.... *cavillaris*

BIBLIOGRAPHY

Byers, C. F. 1930. *Contribution to the Knowledge of Florida Odonata.* Univ. of Fla. Pub., Biological Science Series, Vol. 1, No. 1.

Broughton, Elsie. 1928. *Some New Odonata Nymphs.* Canad. Ent. 60:32-34, figs.

Muttkowski, R. A. 1910. *Catalogue of the Odonata of North America.* Bull. Public Mus., Milwaukee.

Needham, J. G. and H. B. Heywood. 1929. *Handbook of Dragonflies on* Canad. Ent. 29:184.

Needham, J. G. and Charles A. Hart. 1901. *The Dragonflies of Illinois* Bull. Ill. State Lab. of Nat. Hist. 6:77.

Needham, J. G. and H. B. Heywood. 1929. *Handbook of Dragonflies of N. Amer.*, p. 109, figs. C. C. Thomas, Springfield.

Needham, J. G. 1948. *Studies on N. Amer. Species of the Genus Gomphus.* Trans. Amer. Ent. Soc. 73:307-339.

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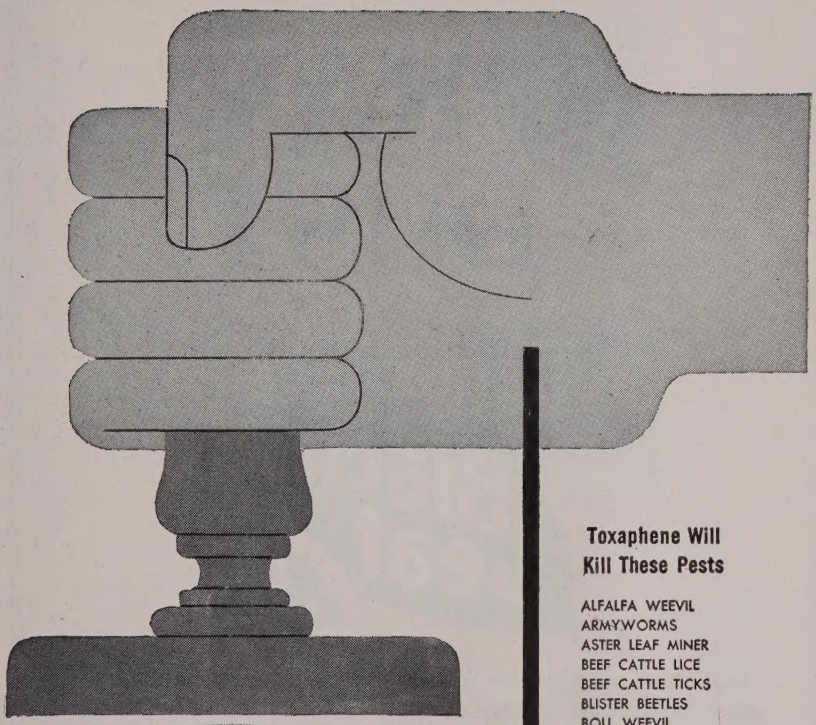

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